Chemical & Biological NONPROLIFERATION PROGRAM Strategic Plan

Foreword

The threat of an attack with chemical or biological weapons on U.S. citizens is a high priority concern. Events such as the World Trade Center and Oklahoma City bombings, the Tokyo subway nerve gas attack, and several bio-terrorism scares have galvanized U.S. Government efforts to combat terrorism, particularly chemical and biological terrorism.

In the face of such threats, our national security is increasingly defined by our ability to respond in a technologically advanced way. The Department of Energy's (DOE) unique scientific horsepower, infrastructure and its historical role in national security issues demand that we contribute to responding to these new and evolving threats.

At the DOE, we are applying the extensive expertise of our national laboratories to contribute advanced technological solutions to the chemical and biological threat. At its core, the Department is a science and technology agency. Over the last 50 years, we have developed enormous technical expertise in pursuit of our primary missions. The Department's role in the nuclear sciences is well known; less well known is its expertise in the biological and chemical sciences. Our work in the biological sciences began with early studies of the effects of radiation on the human body and continues today with programs to develop new biological diagnostics and to sequence the human genome. Our biological expertise combined with important capabilities in chemistry, modeling and simulation, and relevant engineering sciences form the basis of our efforts to assist the Government-wide effort to counter the chemical and biological threat.

The mission of the DOE Chemical and Biological Nonproliferation Program (CBNP) is to develop, demonstrate, and deliver technologies and systems that will lead to major improvements in the U.S. capability to prepare for and respond to chemical or biological attacks. Central to the success of the CBNP is its five-year strategic plan, described herein.

I am personally committed to this effort so that we might achieve the President's vision of confronting those who might seek to harm American citizens with weapons of mass destruction.

Bill Richardson

Bill Richardson
Secretary of Energy

Mission

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"Together we must also confront the new hazards of chemical and biological weapons, and the outlaw states, terrorists and organized criminals seeking to acquire them."

—President William J. Clinton, State of the Union Address, 1998

"[T]he threat posed to the citizens of the United States by nuclear, radiological, biological, and chemical weapons delivered by unconventional means is significant and growing… The United States lacks adequate planning and countermeasures to address the threat of nuclear, radiological, biological, and chemical terrorism."

—The Defense Against Weapons of Mass Destruction Act of 1996

Introduction

Preparing for, and ultimately responding to, the domestic use of chemical or biological agents presents enormous challenges: the quantity of agent required to cause mass casualties is small and the possible spectrum of agents is broad, presenting formidable detection problems. The operational issues associated with responding to chemical or biological events involving civilians are complex and distinct from the issues the military faces on the chemical and biological battlefield, where proper training, well defined operational procedures, and available protective equipment are the norm.

Because of these challenges, responding to chemical and biological terrorism requires a "defense in depth" strategy as illustrated in Figure 1. This "preparation-response spectrum" includes: i) Prevention and Preparation to deter an attack and prepare key facilities and cities for possible attacks; ii) Crisis Management to enable rapid and reliable detection of an attack and, should an attack be detected, to provide a capability for immediate and effective response; iii) Consequence Management to counter the effects of a chemical or biological release, including decontamination of facilities, land, and equipment, and restoration to acceptable civilian safety standards; and iv) Forensics and Attribution to support post-incident criminal investigations and assignment of responsibility.

The strategy of the Department of Energy's Chemical and Biological Nonproliferation Program (CBNP) relies on close linkage between technology development and systems analysis and integration to systematically and comprehensively address the domestic chemical and biological terrorism threat.

The CBNP is comprised of three key components:

- Definition of operational needs to guide the development and implementation of enhanced preparedness and response systems.
- Use of accelerated system demonstrations to enable rapid fielding of the best available systems and technologies to meet critical needs.
- Development of individual technologies to enhance capabilities across the full spectrum of chemical and biological threats.

Central to the success of the CBNP is its five-year strategic plan, summarized in this document, in which research and development (R&D) is guided by and linked to systems analysis efforts that merge both technological and operational factors to achieve enhancements in fielded capabilities. These system integration efforts, which include both existing and emerging technologies, will result in fielded prototype systems targeting each principal phase of a chemical or biological terrorism incident. The program builds upon key areas of Department of Energy (DOE) expertise while drawing upon the ongoing R&D efforts of other U.S. government agencies.

Figure 1: Preparation—Response Spectrum for a Chemical or Biological Terrorism Incident

Background

U.S. Antiterrorism Policy

U.S. policy to combat terrorism has been evolving since the 1970s, when it was formalized with President Reagan's issuance of National Security Decision Directive 207 that focused on crisis response to terrorist incidents abroad. It named the Federal Bureau of Investigation (FBI) as lead agency for domestic terrorism response. In 1995 President Clinton issued a Presidential Decision Directive that elaborated on this policy and established a national response strategy and an interagency coordination mechanism for combating terrorism. The FBI was reaffirmed as the lead federal agency for crisis response, and the Federal Emergency Management Agency (FEMA) was tasked as the lead agency for managing the consequences of an attack. The Department of Defense (DoD) and DOE, each with specific technical expertise not resident within the FBI or FEMA, work in support of the lead agency.

In May 1998, President Clinton signed two new Presidential Decision Directives, which address the roles and missions of various federal organizations involved in countering weapons of mass destruction (WMD) terrorism, and the protection of critical national infrastructure elements. In addition to these Presidential Directives, there have been a number of legislative actions to address the terrorist threat from weapons of mass destruction.

Origin of DOE's CBNP

The CBNP was established by DOE in 1997 in response to the *Defense Against Weapons of Mass Destruction Act* ("Nunn-Lugar-Domenici") passed by Congress in 1996. The CBNP was established to ensure the full engagement of the DOE National Laboratories in responding to the threat posed by chemical and biological weapons to U.S. civilians.

DOE and the National Laboratories have a long history of supporting nonproliferation and national security policy. As part of its primary nuclear science and technology mission, DOE invests over $1 billion annually in the chemical, material and biological sciences at its laboratories. These investments, in areas such as genomic sequencing, development of new DNA-based diagnostics, advanced modeling and simulation, and microfabrication technologies and the nexus of these capabilities with expertise in nonproliferation and national security, form the basis for a strong DOE role in combating the chemical and biological threat. In addition to the chemical and biological nonproliferation activities supported by the DOE, the National Laboratories conduct over $50 million per year in chemical and biological related research for other government agencies in direct support of their missions.

> "Domestic security is increasingly defined by our ability to respond to technologically advanced attacks. DOE's unique scientific capabilities and expertise in national security issues demand that we do everything we possibly can to combat the chemical and biological threat."
>
> —*Bill Richardson*, *Secretary of Energy*

The Problem . . . Critical Capability Shortfalls

The period of relative stability that accompanied global deterrence during the Cold War has given way to new national security threats. The threat of terrorist attacks against U.S. citizens and property has become a higher priority national security and law enforcement concern. Even the prospect of a calculated WMD attack by a nation state must be considered as a potential threat.

The relative ease of producing chemical and biological weapons is alarming. Technical information and the necessary materials and equipment are readily available, and production of chemical or biological weapons does not require large or complex facilities (e.g., compared to a nuclear weapon development program). The combination of ease of access to such weapons and the intent to inflict harm on the U.S. suggests that developing an effective preparation and response capability is critical now and will remain so for the foreseeable future.

Recent incidents involving terrorist threats of chemical and biological agents have highlighted the need to enhance capabilities to respond to these threats. Deficiencies have been noted in all response areas, ranging from training and equipment for first responders, to medical treatment options. A common theme among these deficiencies is the lack of adequate technologies to support effective preparation and response options. In fact, in many cases, technology is an enabling factor, which if not available could preclude any effective response (or one that is too late to be effective).

The CBNP works closely with other federal agencies (including the DoD, FBI, FEMA, Health and Human Services (HHS), and the intelligence community) and representatives of state and local emergency responders to identify capability shortfalls which inhibit effective preparation and response to chemical and biological terrorism.

Some of the key needs identified through this cooperative process include:

- **Detection**. Sensors capable of detecting a broad spectrum of agents and subject to minimal false alarms. Improved epidemiological systems to identify anomalous outbreaks.

- **Prediction**. Models that can accurately and rapidly predict the dispersion and effects of chemical and biological agent releases in urban areas.

- **Restoration and Recovery**. Environmentally sensitive decontamination techniques requiring minimal logistical support. Rapid decontamination of emergency responders and large numbers of civilians.

- **Protection**. Improved personal protection equipment that enables emergency personnel to operate in contaminated environments for long periods of time.

- **Therapeutics**. Improved vaccines and medical response options against a wide range of chemical and biological agents.

- **Forensics**. Detailed understanding of the DNA/RNA structure of pathogens to enable strain identification and differentiation. Rapid sample screening techniques.

- **Systems Analysis**. Optimization of preparation and response approaches across all phases of the preparation-response timeline. Integration of key enabling technologies into operational systems.

Program Structure: Technology Development and System Integration Initiatives

The CBNP is structured to capitalize on existing DOE technical strengths in developing capabilities, both near- and long-term, that can have a major impact on civilian preparation and response to chemical and biological terrorism incidents. The program is divided into Technology Development and System Integration Initiatives selected based on an assessment of DOE capabilities and identified needs.

The CBNP is differentiated from related efforts in the following ways:

- The CBNP seeks to provide major capability advances in the 3—5 year time frame, and is
- focused on the development of robust capabilities specifically targeted at the domestic threat.

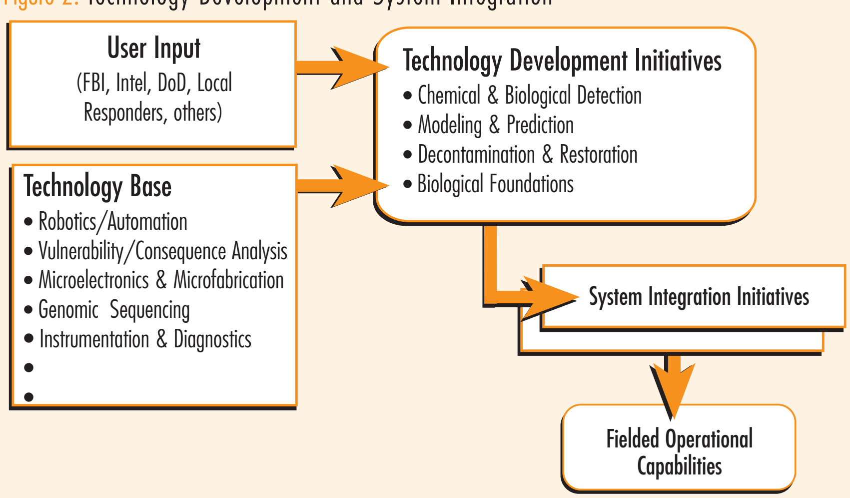
Longer-term challenges and evolving threats are addressed by supporting and leveraging the scientific and technical base resident in the national laboratories.

The **Technology Development Initiatives**, shown in Figure 2, are designed to identify and mature key enabling technologies suitable for integration into operational systems in 3 - 5 years. In addition, single instruments or capabilities that have utility outside of a particular CBNP technology integration effort will be made available directly to end users in the law enforcement, first responder, military support, public health, and intelligence communities.

The **System Integration Initiatives** bring together the best available near-term technologies and appropriate operational concepts into an integrated architecture to address particular capability needs over a 2 - 3 year time frame. They draw upon DOE technologies as well as commercially available technologies to form the fielded capability. Follow-on generations of integrated systems are expected as technology development efforts mature.

The linkage between the Technology Development and System Integration Initiatives is illustrated in Figure 2 along with their time-phased development approach. The major goals and R&D challenges for each initiative are discussed in the following sections, along with CBNP's technology development roadmap (Figure 4).

Figure 2: Technology Development and System Integration



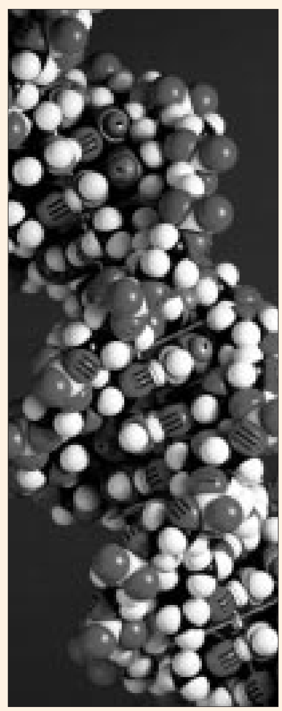
Technology Development Initiatives

1. Biological Foundations

Goal.

The objective of this initiative is to develop molecular biology based capabilities to support efforts in advanced detection, attribution, and medical countermeasures. Detailed study of both biological agents and ambient background microbiological populations, at the DNA and structural level, will enable rapid, conclusive identification of agents; recognition of bio-engineered features, such as antibiotic resistance; geographic source determination; event reconstruction and attribution; and development of vaccines and treatments for both pathogens and toxins.

R&D Challenges.



While advances in genetic engineering and molecular biology offer more robust methods of agent detection, they also offer tools to assist potential adversaries in creating more effective and lethal weapons. The research challenge lies in being able to conclusively recognize agents by their specific DNA and structural signatures in the presence of interfering background signals. This same challenge is also apparent on macroscopic scales, where disease monitoring and epidemiological tools must differentiate between naturally occurring outbreaks, production accidents, or those due to an intentional terrorist attack.

Recent efforts have suggested that the development of new techniques capable of identifying and differentiating biological species down to the strain level may form the basis of a robust forensics capability. Similarly, new computational techniques may allow the reconstruction of particular biological events (i.e., based on molecular epidemiology) and are likely to be an important part of an incident response arsenal when used in conjunction with traditional epidemiological investigations. Finally, efforts in 3-dimensional structural determination of toxins indicate the potential of these techniques for designing new detection and treatment approaches.

R&D Initiative.

This work builds upon DOE capabilities in DNA sequencing and advanced light sources used in biological structure determination. Ongoing work under this initiative can be divided into three broadly-based efforts: Nucleic Acid-Based Signatures, Toxin Structural Signatures, and Molecular Epidemiology and Tracking. These efforts are aimed at providing the biological data necessary to underpin advanced detection and forensics capabilities. Within three years the program will develop the capability to geo-locate samples (i.e., identify the geographical region where biological strains originate) of the two highest priority threat pathogens, partially locate an additional six pathogens, and develop an initial capability to recognize bio-engineered organisms.

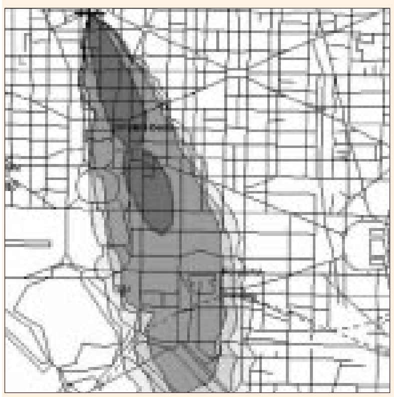
2. Modeling and Prediction

Goal.

The objective of the Modeling and Prediction Initiative is the accurate prediction of chemical and biological agent dispersal during the multitude of release scenarios that might occur in an urban environment. This is essential to safeguarding human life and to the effective operation of emergency response teams.

R&D Challenges.

Methods of predicting atmospheric dispersion are commonly applied on transport scales of hundreds of meters to several kilometers over simple configurations of terrain and surface obstacles. However, the particular needs of predicting, diagnosing, controlling, and responding to clandestine chemical or biological releases in an urban setting with complex building configurations, require modeling capabilities that are beyond current capabilities.



Outdoor modeling challenges are posed by the highly distorted wind and turbulence fields created by complexes of tall buildings, subway tunnels, and other urban structures. Models of airflow inside buildings and subways must be adapted to include deposition losses to interior surfaces, a large effect due to the high surface to volume ratios typically encountered. Current understanding of surface phenomena and agent/analyte deposition and fate, including chemistry and bio-agent viability, must be incorporated into the models. A final challenge is the coupling of predictive models at different scales (e.g., from transport around buildings to transport within buildings) and at different levels of model complexity (e.g., 3-D subway station flow and parameterized subway system transport involving tunnels, train movement effects, and multiple stations).

R&D Initiative.

This effort builds upon substantial investments by DOE and the National Laboratories in high-performance computing. The modeling effort supported by the CBNP is aimed at developing a robust, operational modeling capability suitable for use in urban areas. Initiative elements include models for air flow and transport within building interiors and subways, models for flow around buildings, and the linking of these models to form an integrated, multi-scale computational capability. Crosscutting issues, including understanding the surface deposition of chemical and biological agents and their fate under typical environmental conditions, are also being investigated. Together, advancements in these areas will enable accurate predictions of the extent and impact of a chemical or biological terrorism incident. Within two years these models should be mature enough to provide operational guidance for incidents in subways and buildings, and within five years outdoor urban models will be incorporated into a validated operational system (such as the National Atmospheric Release Advisory Capability, NARAC).

3. Chemical and Biological Detection

Goal.

The goal of this initiative is to develop a suite of detection systems that will significantly improve chemical and biological detection capabilities in urban environments for Federal, state and local responders. Implicit in this goal is a recognition that there is no "silver bullet" to solve this problem and that detection systems must be capable of detecting the many chemicals and biological species that might be used in a terrorist attack.

R&D Challenges.

The challenges in this area are legion and are as difficult, or more so, to address as those encountered when developing chemical and biological detectors for use on the battlefield. The counterterrorism mission must deal with a broader set of agents, and, unlike the battlefield mission, the set of potential agents is not limited by factors such as weaponizability constraints or intelligence information on large scale weapon production, stockpiling, and delivery systems. The terrorist is free to choose from well over 100 potential agents. Because it cannot be predicted in advance which agent(s) might be used, an effective detection system must be capable of identifying a wide range of agents, and be able to add new agent detection capabilities easily to be responsive to new and emerging threats.

In addition to having high sensitivity, detectors designed for use in civilian response situations must meet very demanding false positive requirements. Law enforcement personnel are unwilling to accept the disruptions caused by false positives leading to unnecessary evacuations of, for example, subway stations or large office buildings. Continuous monitoring for chemical or biological attacks could involve over 100 million individual measurements per year. Over this time period, even 1 or 2 false alarms may not be acceptable. Compounding the urban detection problem is the absence in most cities of any supporting infrastructure to facilitate the implementation of a detection and warning network. This places significant constraints on the cost, ease of use, and maintainability of urban chemical and biological detection systems.

R&D Initiative.

This work builds upon DOE advances in laser technology, capabilities in micro-fabrication, and work in the development of DNA-based diagnostics. Key efforts include the development of an autonomous biological agent detector, a DNA fragment sizing system, a hand-held chemical agent detector, and an improved mass spectrometer. Each instrument targets a particular portion of the chemical-biotoxin-pathogen threat space and also detects a different physical property, thereby providing independent detection confirmation when two or more techniques are used in combination, further reducing the possibility of false alarms. The techniques differ in their level of technical maturity, development risks, and benefits and, hence, comprise a well-balanced detection portfolio.

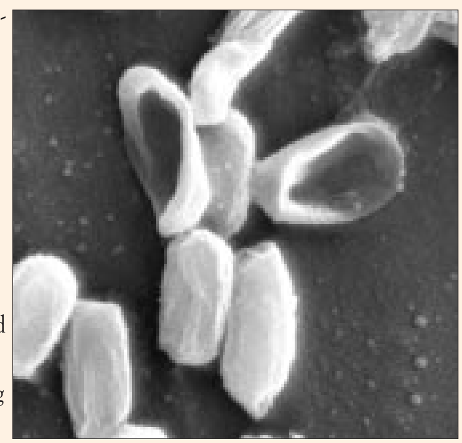
4. Decontamination and Restoration

Goal.

The objective of the Decontamination and Restoration Initiative is to develop rapid, effective, and safe (non-toxic and non-corrosive) decontamination technologies for a range of chemically and biologically contaminated surfaces. Additionally, standards are sought for sampling and analysis methods to ensure compliance with acceptable civilian cleanup criteria.

R&D Challenges.

There are numerous R&D challenges associated with the safe and effective decontamination of urban facilities. One is the development of a decontaminant formulation that can destroy (or detoxify) hazardous chemicals or pathogens while remaining harmless to both people and property, or degrade to such in a reasonable period of time. Additional constraints are imposed by the desire to have a common formulation effective for all chemical and biological agents, while being suitable for use with the variety of construction materials encountered in urban environments. There are major logistical and operational issues to which any new technology must be sensitive. For example, different applications (e.g., outdoors, semi-enclosed, indoors, sensitive equipment) will require different application methods, which might include liquid-based, gas-based, gel-based, and/or foam-based formulations. Any proposed reagent must be deployable by a variety of methods, with easy to use delivery systems and simple operating procedures to ensure effective first responder support.



It will also be important to develop appropriate sampling and analysis methods to monitor and demonstrate the adequacy of the decontamination process as it proceeds. These techniques must be able to measure the extent of residual contamination on a multitude of surface materials in a reproducible way.

R&D Initiative.

This work builds upon DOE expertise in understanding fundamental biology and chemistry and advanced diagnostic instrumentation. Current efforts focus on methods that are minimally corrosive and yet effective for decontamination and include: the development of improved reagents and delivery systems (e.g., gels and foams); advanced decontamination techniques, such as low temperature plasmas; and a study to address the environmental issues associated with urban decontamination. Over the next three years, systems will be fielded that are suitable for decontaminating sensitive, exposed surfaces characteristic of those typically found in urban environments.

System Integration Initiatives

Despite the concern over the chemical and biological terrorism threat, a coherent analytical structure is lacking for characterizing the threat, developing preparation and response options, assessing the performance of alternative capabilities against various threats, and establishing investment priorities. The System Integration Initiatives take on this challenge.

A key component of the CBNP is the development of integrated system architectures for specific preparation and response applications. An architecture defines the roles of infrastructure, operations, and technology in responding to the threat. It also serves as a structure for determining how multiple technologies should be integrated into an overall system. During the systems analysis process, system performance objectives are clearly defined and tradeoffs among system elements are explored to arrive at an optimal system design.

An integrated preparation and response system must address the entire preparation-response timeline: from threat identification and monitoring prior to an incident to use detection and warning during a crisis, and from post-incident consequence management and cleanup through criminal forensics and attribution. The various phases of the timeline and examples of response elements in each phase are detailed in Figure 3.

The success of any preparation and response system architecture depends on its effectiveness in addressing each of these response elements. Such a "defense in depth" strategy is characterized by focused R&D, operational planning, training, and technology acquisition decisions made in support of each element.

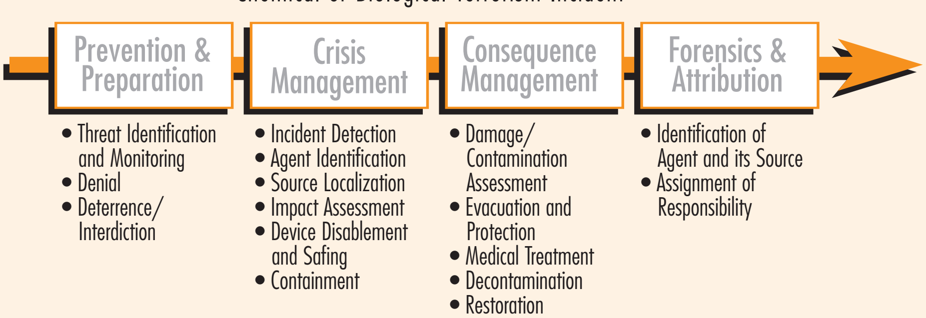
The CBNP has identified four application areas for developing initial integrated system concepts:

- Protection and response to incidents in key facilities;
- Protection and response to incidents during "special events";
- Decontamination and restoration of urban facilities; and
- Forensics and attribution.

These efforts, termed Domestic Demonstration and Application Programs (DDAPs), are designed to integrate available technology into a workable system consistent with practical operational and infrastructure constraints. Demonstrations will quantify the capability of prototype systems and identify shortcomings that need to be addressed in subsequent system modifications. In addition, DDAPs will provide "application pull" to help guide the R&D activities of the four Technology Development Initiatives. For example, current systems concepts in the two protection and response application areas draw on the Modeling and Prediction Initiative for agent plume dispersal prediction. Also, operational concepts are being developed to exploit information available from deployed detection systems such as those under development by the Chemical and Biological Detection Initiative.

The two DDAPS currently being pursued are described below.

Figure 3: Elements of the Preparation—Response Spectrum for a Chemical or Biological Terrorism Incident



1. PROTECTS—Program for Response Options and Technology Enhancements for Chem/Bio Terrorism.

The objective of this civilian infrastructure protection DDAP is the fielding of technologies and analysis tools to support protection of “at risk” facilities. A pilot study focuses on the subway system of a major metropolitan area. Current assessments reveal that the nation’s subway systems are not prepared to detect or respond to chemical and biological threats. Analysis and modeling are being used to support sensor development and integration, data management, and development of associated operational response concepts. By the year 2001 an integrated sensor network will be installed at five stations in the pilot subway system. The sensor network will be linked with interior modeling and prediction codes to support crisis and consequence management response options. Lessons learned from this project will be utilized to adapt and install operational integrated sensor networks in other subway systems, as well as key facilities such as airports, arenas and high-rise buildings.

2. CCMIS—Crisis/Consequence Management Information System.

The objective of this biological sentry and crisis management DDAP is to produce a portable system for protecting special events or for deployment to a major city during high alert conditions. Currently, state and local authorities have no means for detecting biological agents and predicting the evolving hazard zone. This effort includes systems architecture development, sensor development and integration, modeling support, and demonstration and testing activities. By the year 2002, a deployable bio-sensor network will be available, along with supporting urban hazard assessment models that receive and process sensor inputs, and the integrated planning tools, databases, and communications resources necessary to support crisis and consequence management operations.

Two additional DDAPs are being considered for an FY 2001 start:

- Recovery & Restoration DDAP – to demonstrate and field a decontamination and restoration system capable of restoring a medium-sized building to appropriate civilian safety standards; and
- Forensics & Attribution DDAP – to demonstrate and field a capability for rapid identification of biological strains and regional origins for the most threatening biological pathogens.

Program Management and Coordination

CBNP Management

The CBNP is managed by DOE's Office of Nonproliferation and National Security, Office of Research and Development (NN-20). The CBNP is led by Dr. Page Stoutland, who is assisted by Dr. Richard Wheeler and Dr. Eric Kaufman. This small staff is augmented as required by DOE laboratory personnel and contractor assistance.

Management of the program emphasizes integrating themes, as reflected in the basic program structure described above. To ensure quality program execution, regular program reviews are held with redirection made as needed. In addition to quarterly review meetings with representatives from the technology development and system integration initiative areas, the program conducts external, independent reviews of proposed activities.

"In the end, the solution to the WMD response mission requires a partnership – military and civilian."
—*Department of Defense Plan for Integrating National Guard and Reserve Component Support for Response to Attacks Using Weapons of Mass Destruction*, January 1998

External Interfaces and Coordination

Other important Federal activities are focused on improving our preparation and response to the potential use of chemical or biological agents. The Department of Health and Human Services is forming Metropolitan Medical Strike Teams, developing new vaccines and therapeutics, and is stockpiling vaccines and therapeutics. The Department of Defense, in addition to supporting the warfighter, plays a key role domestically. Research and development of technologies that may have dual-use (for the warfighter and domestically) are being developed, new teams have been assembled to deal with the consequences of potential attacks (e.g., CBIRF, RAID, etc.), and the SBCCOM Domestic Preparedness Program is training responders in cities around the country. The interagency Technical Support Working Group supports a broad range of counter-terrorism technology development efforts, targeting incremented enhancements that can be implemented in a 12—18 month time frame. Finally, the Federal Bureau of Investigation plays a key role in the development and use of technologies to aid in criminal prosecution.

The DOE CBNP is designed to complement these and other programs while relying on the unique capabilities of the DOE laboratories. To avoid duplication of effort, the CBNP interacts with related efforts by a number of formal and informal coordination mechanisms. Formal coordination occurs via the Counterproliferation Program Review Committee, the Nonproliferation and Arms Control Technology Working Groups, and the Measurement and Signature Intelligence (MASINT) Biological Warfare Steering Group.

Informal coordination occurs routinely via information exchanges and working level contacts between the CBNP and various DoD organizations, the Department of Justice (FBI and National Institute of Justice), HHS (Public Health Service, National Institute of Health and Centers for Disease Control), FEMA, the Department of Transportation, and others. The CBNP also sponsors an annual "Summer Meeting" to review the status of each initiative area. This meeting attracts participants from across the chemical and biological counterterrorism community.

Program Roadmap

The CBNP's technology development and integration roadmap is illustrated in Figure 4, which portrays how the four Technology Development Initiatives support the System Integration DDAPs. Key milestones are noted. The technical goals and timelines for each DDAP were determined through an iterative process that estimated the resources and development times required to achieve major advances in capability, constrained by the existing state of knowledge and limitations imposed by practical ramp-up rates to ensure efficient resource utilization by the DOE National Laboratories.

Figure 4: CBNP Five-Year Plan: Major Milestones

		FY00	FY01	FY02	FY03	FY04
System Integration/DDAPs	Infrastructure	Subway vulnerability assessment/response strategies ○	Chemical detection demonstration (five stations) ○ □	Prototype automated response system testing ○ □	Emergency mgmt and training/bio detection demonstration ○ □ △	Preparedness system fielded for four subway systems ○ □ ◇ △
System Integration/DDAPs	Early Warning	Architecture development for city protection ○	Establish planning/response support center ○	Response exercise with limited bio sensor demonstration ○ □	Bio sensor network linked to models/data; fielded for one city ○ □	Enhanced system with deployment to other cities ○ □ △
System Integration/DDAPs	Forensics		Bioagent "geolocation" capability for two pathogens □ △	Limited capability to recognize genetically engineered agents □ △	Technological protocols for event reconstruction ○ △	"Geolocation" and engineered agent ID for additional agents □ △
System Integration/DDAPs	Decontamination		System design studies ◇	Mobile spray and gaseous systems demonstrations ◇	Initial system fielded with sampling & analysis tools ○ □ ◇ △	Enhanced system fielded with detection capability ○ □ ◇ △
Technology Development	Biological Foundations △	DNA fingerprinting of top ten BW pathogens	Laboratory standards for genetic analysis using DNA fingerprints	Identification of virulence pathways for five BW agents	Ten-fold improvements in time and cost for DNA based detection	Structure/function relationships determined for top ten biotoxins
Technology Development	Modeling and Prediction ○	Guidance for response to releases in office buildings	Validated model for flow prediction in interiors/subways	Integrated int/ext. model for vulnerability analysis	Begin transition to operational capability	Operational outdoor predictive capability fielded for national use
Technology Development	Detection □	Handheld prototype tested on top chem & biotoxin agents	Ten-fold increase in sensitivity of personal "bioticket"	Demonstrate DNA analyzer to classify unknown pathogens	Field test autonomous sensor for ten BW pathogens	Field test virus module in handheld chem & biotoxin sensor
Technology Development	Decontamination ◇	Live agent testing with environmentally benign gels & foams		Water-mist system tested and fielded	Dry plasma-based system tested on broad range of materials	

△ ○ □ ◇ Icons show how technology development initiatives feed into system integration efforts

Budget

The CBNP was established with an initial FY 1997 budget of $17 million and has been supported at $19 million in each of FY 1998 and 1999. The FY 2000 request is $32M, and resource requirements in subsequent years will rise to over $100M per year to meet the goals outlined in this plan. These funding increases are required to support the delivery of equipment prototypes to end users, development of the PROTECT and CCMIS system demonstrations, and planning and definition of new demonstrations.

The resource requirements reflect the program goals of developing, demonstrating and delivering technology that will lead to major improvements in our preparedness and response capabilities. They are based upon historical data for the costs of related technology development and integration programs within both the government and the private sector.

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"Because of our military superiority, potential
organizations, are increasingly likely to attack
tempted to . . . use weapons of mass destruction
when we gather as a community at special even
century, I am determined that we will be prepa
the damage they can inflict." • *"As the new m*
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